

MBL400E33D

Silicon N-channel IGBT

FEATURES

- * High thermal fatigue durability.($\Delta T_c=70^\circ\text{C}$, $N>30,000$ cycles)
- * High speed, low loss IGBT module.
- * Low noise due to built-in free-wheeling diode
 - ultra soft fast recovery diode(USFD).
- * Low driving power due to low input capacitance MOS gate.
- * High reliability, high durability module.
- * Isolated heat sink (terminal to base).

ABSOLUTE MAXIMUM RATINGS ($T_c=25^\circ\text{C}$)

Item	Symbol	Unit	MBL400E33D
Collector Emitter Voltage	VCES	V	3,300
Gate Emitter Voltage	VGES	V	± 20
Collector Current	DC	IC	400
	1ms	ICp	800
Forward Current	DC	IF	400
	1ms	IFM	800
Junction Temperature	Tj	$^\circ\text{C}$	-40 ~ +125
Storage Temperature	Tstg	$^\circ\text{C}$	-40 ~ +125
Isolation Voltage	VISO	VRMS	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/22 (1)
	Mounting (M6)	-	6 (2)

Notes: (1) Recommended Value $1.8\pm 0.2/22\pm 1\text{N}\cdot\text{m}$ (2) Recommended Value $5.5\pm 0.5\text{N}\cdot\text{m}$

ELECTRICAL CHARACTERISTICS

1) IGBT + FWD

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	ICES	mA	-	-	12.0	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_j=25^\circ\text{C}$
Gate Emitter Leakage Current	IGES	nA	-	-	± 500	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_j=25^\circ\text{C}$
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	3.5	4.2	5.0	$I_C=400\text{A}$, $V_{GE}=15\text{V}$, $T_j=125^\circ\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(TH)}$	V	4.5	6.0	7.0	$V_{CE}=10\text{V}$, $I_C=400\text{mA}$, $T_j=25^\circ\text{C}$
Input Capacitance	Cies	nF	-	35	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_j=25^\circ\text{C}$
Internal Gate Resistance	Rge	Ω	-	3.6	-	
Switching Times	Rise Time	tr	1.0	1.9	3.1	$V_{CC}=1,650\text{V}$, $I_C=400\text{A}$
	Turn On Time	ton	1.5	2.4	3.3	$L=150\text{nH}$
	Fall Time	tf	0.5	1.0	2.5	$R_G=10\Omega$ (3)
	Turn Off Time	toff	2.0	3.0	5.1	$V_{GE}=\pm 15\text{V}$, $T_j=125^\circ\text{C}$
Peak Forward Voltage Drop	VFM	V	2.0	2.5	3.0	$-I_C=400\text{A}$, $V_{GE}=0\text{V}$, $T_j=125^\circ\text{C}$
Reverse Recovery Time	trr	μs	-	0.6	-	$V_{CC}=1,650\text{V}$, $I_F=400\text{A}$ (4) $L=150\text{nH}$, $T_j=125^\circ\text{C}$
Thermal Impedance	IGBT	$R_{th(j-c)}$	-	-	0.026	Junction to case
	FWD	$R_{th(j-c)}$	-	-	0.052	

2) DIODE

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	I _A K _S	mA	-	-	12.0	$V_{AK}=3,300\text{V}$, $T_j=25^\circ\text{C}$
Peak Forward Voltage Drop	V _F	V	2.2	2.7	3.2	$I_F=400\text{A}$, $T_j=125^\circ\text{C}$ At Main terminal (Terminal resistance:0.5m Ω typical)
Reverse Recovery Time	trr	μs	0.2	0.6	1.1	$I_F=400\text{A}$, $V_{CC}=1,650\text{V}$ (4) $L=150\text{nH}$, $T_j=125^\circ\text{C}$
Thermal Impedance	$R_{th(j-c)}$	K/W	-	-	0.052	Junction to case

Notes: (3) R_G value is the test condition's value for decision of the switching times, not recommended value. Please, determine the suitable R_G value after the measurement of switching waveforms(overshoot voltage, etc.)with appliance mounted.
(4)Counter arm IGBT $V_{GE}=-15\text{V}$

- * Please contact our representatives at order.
- * For improvement, specifications are subject to change without notice.
- * For actual application, please confirm this spec sheet is the newest revision.

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DEFINITION OF TEST CIRCUIT

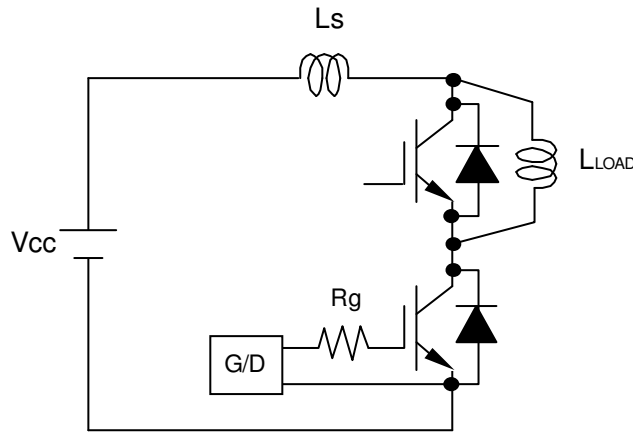


Fig.1 Switching test circuit

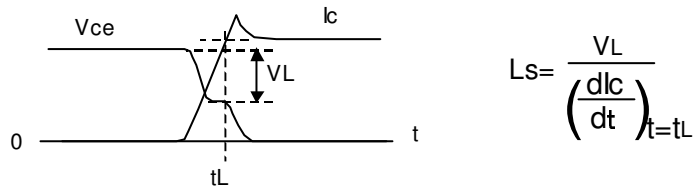


Fig.2 Definition of Ls

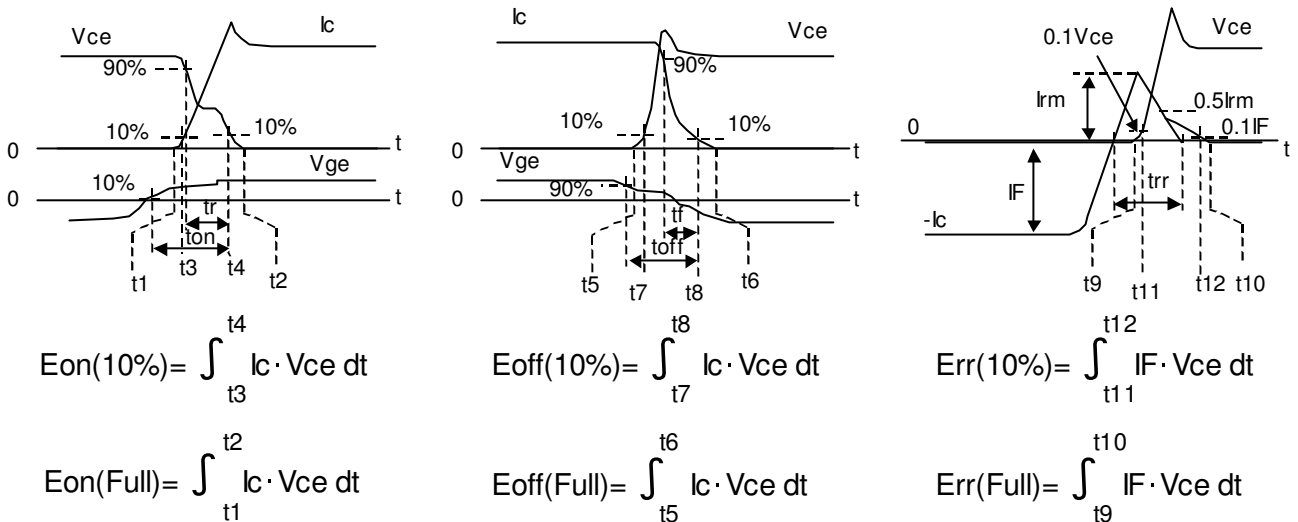
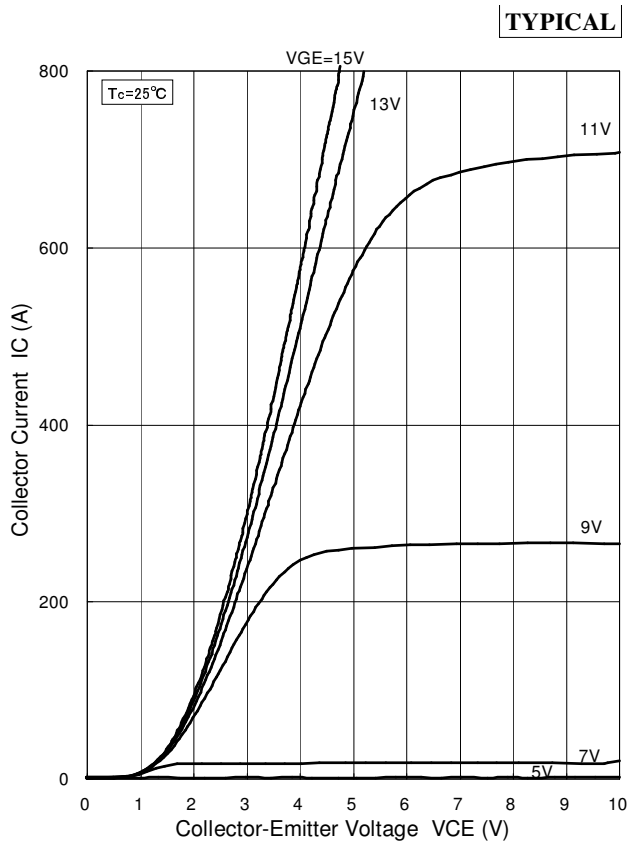


Fig.3 Definition of switching loss

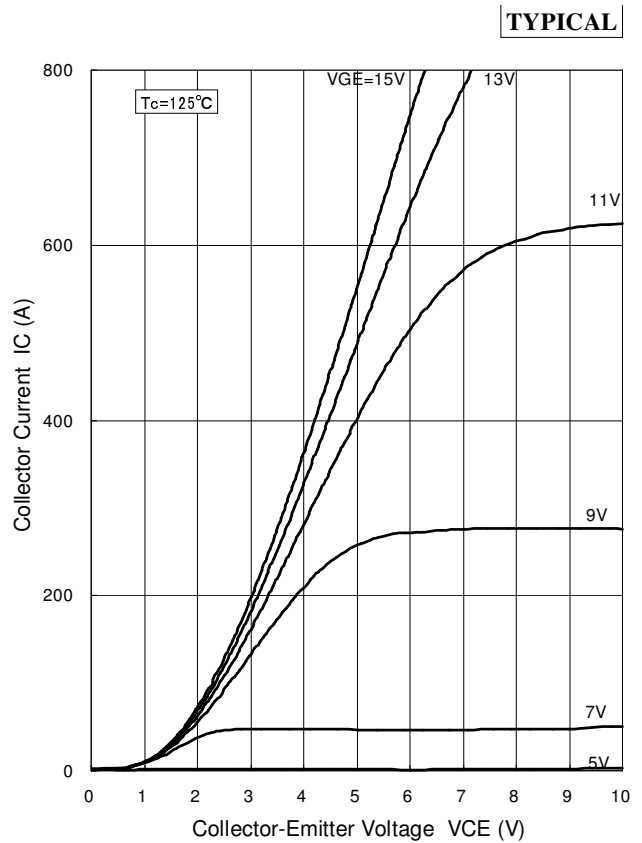
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CHARACTERISTICS CURVE

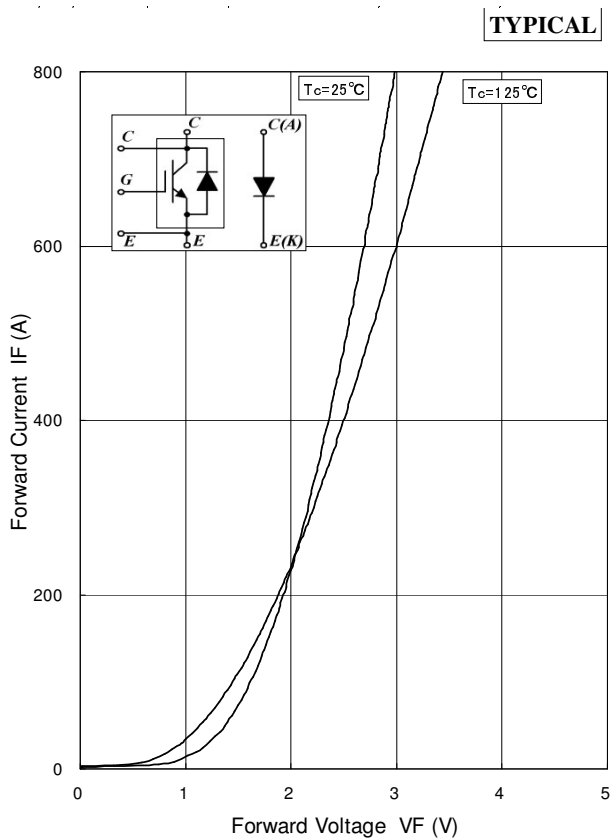
STATIC CHARACTERISTICS



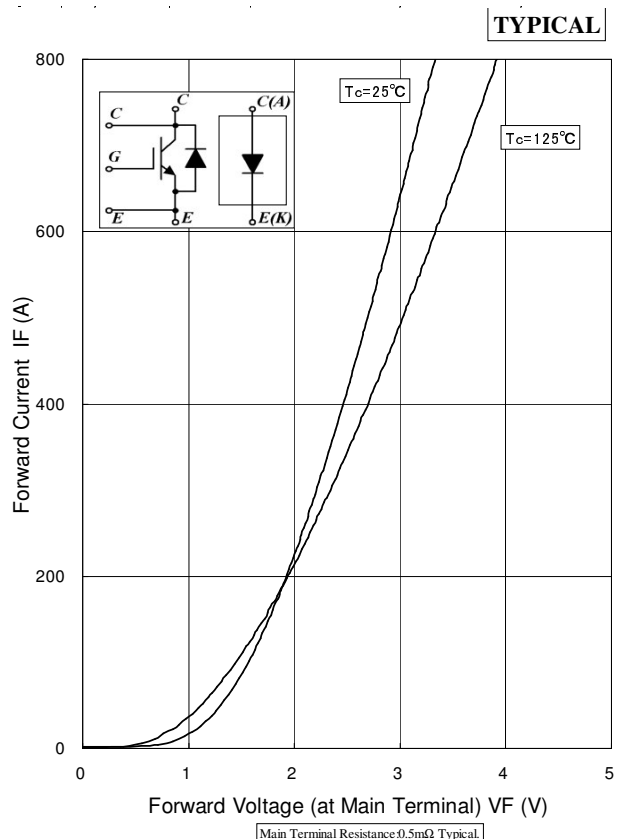
Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Forward Voltage of free-wheeling diode

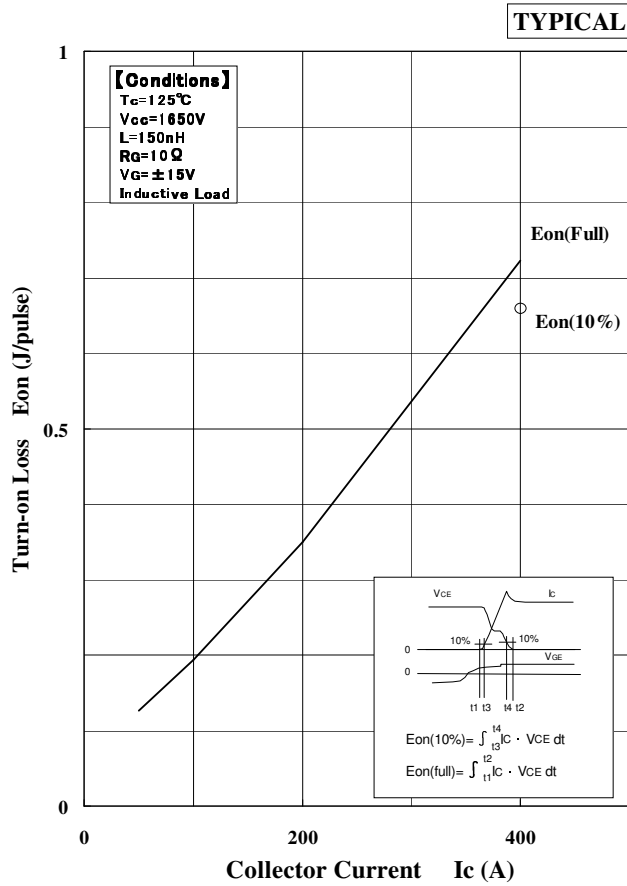


Forward Voltage of chopper diode

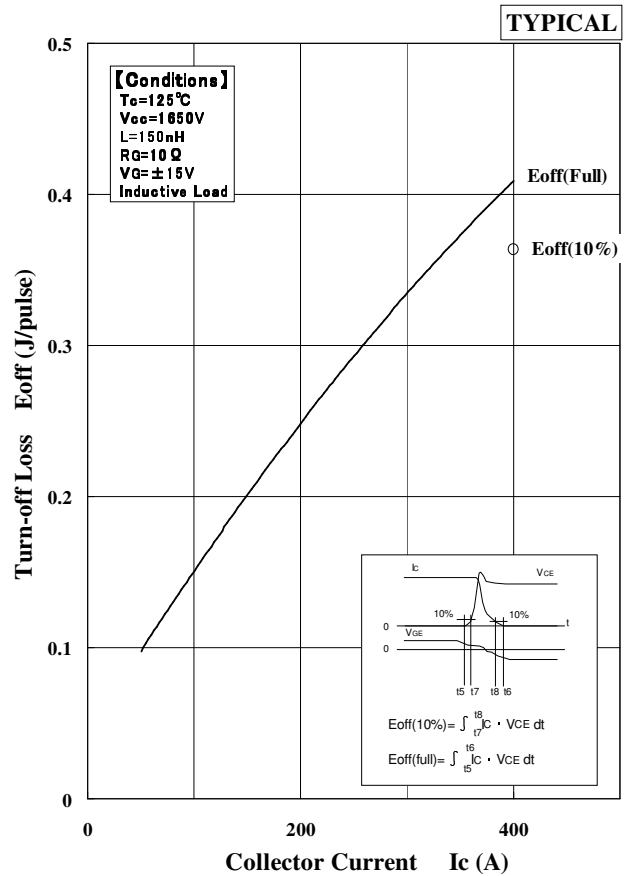
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DYNAMIC CHARACTERISTICS

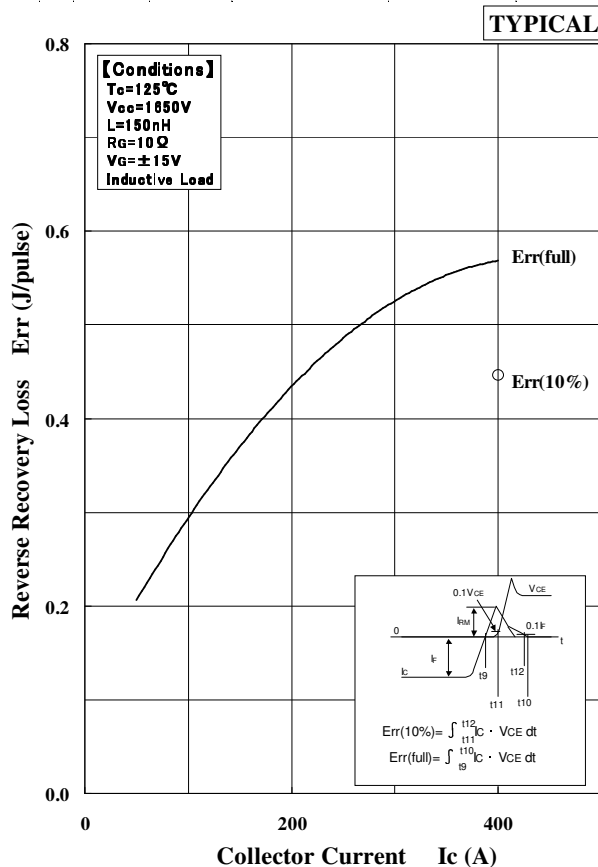
DEPENDENCE OF CURRENT



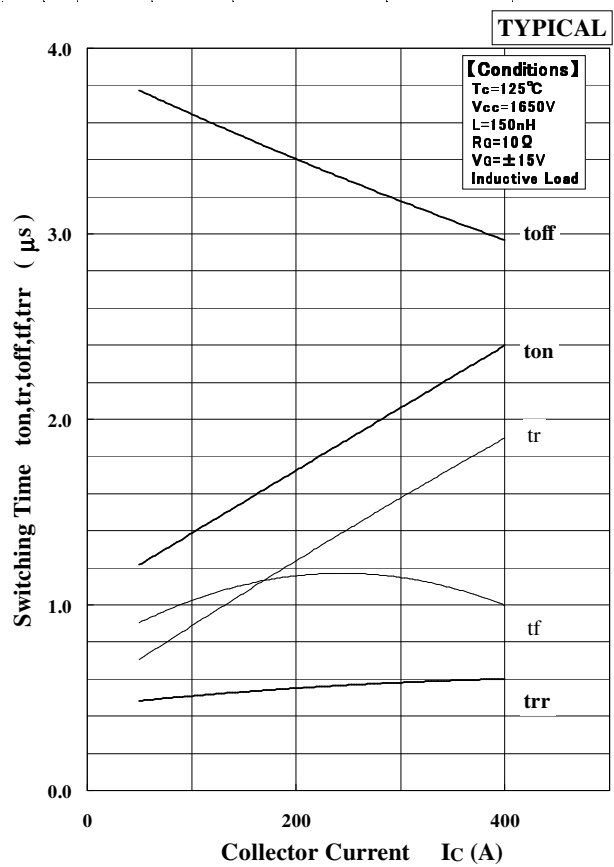
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current



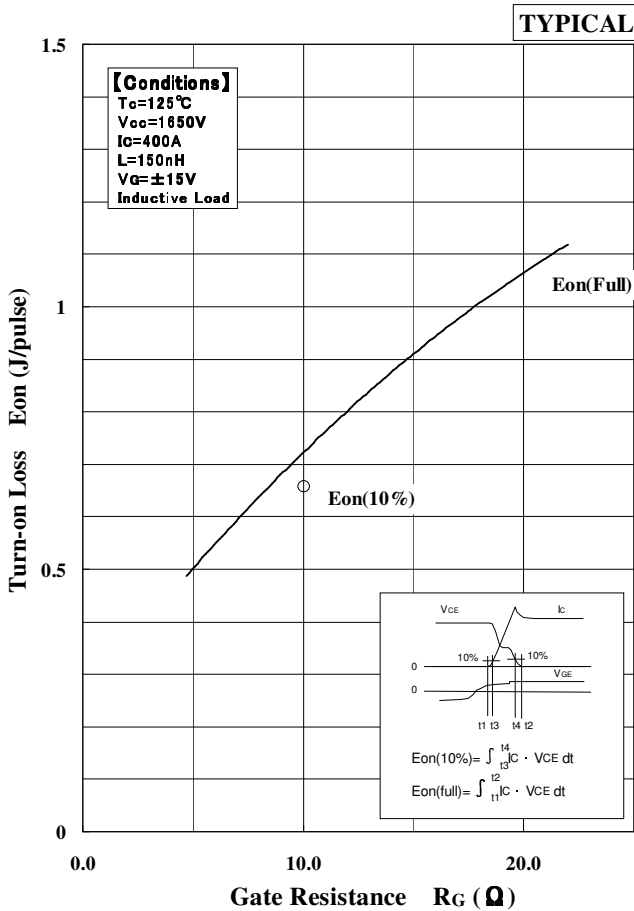
Recovery Loss vs. Collector Current



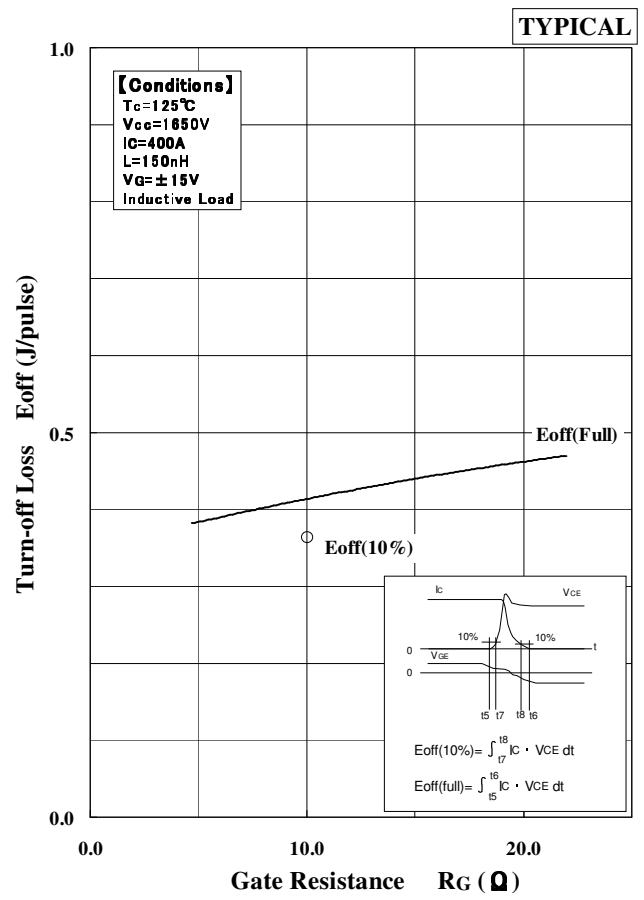
Switching Time vs. Collector Current

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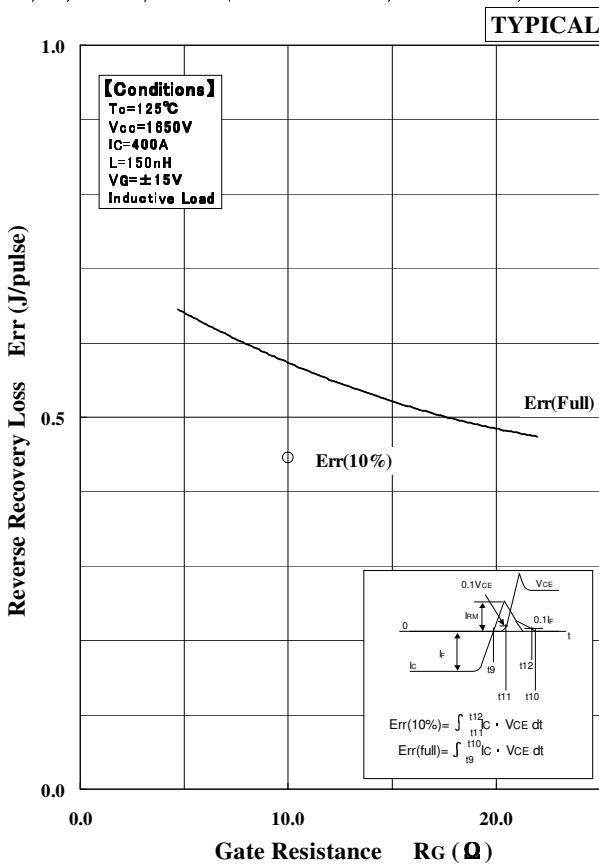
DEPENDENCE OF RG



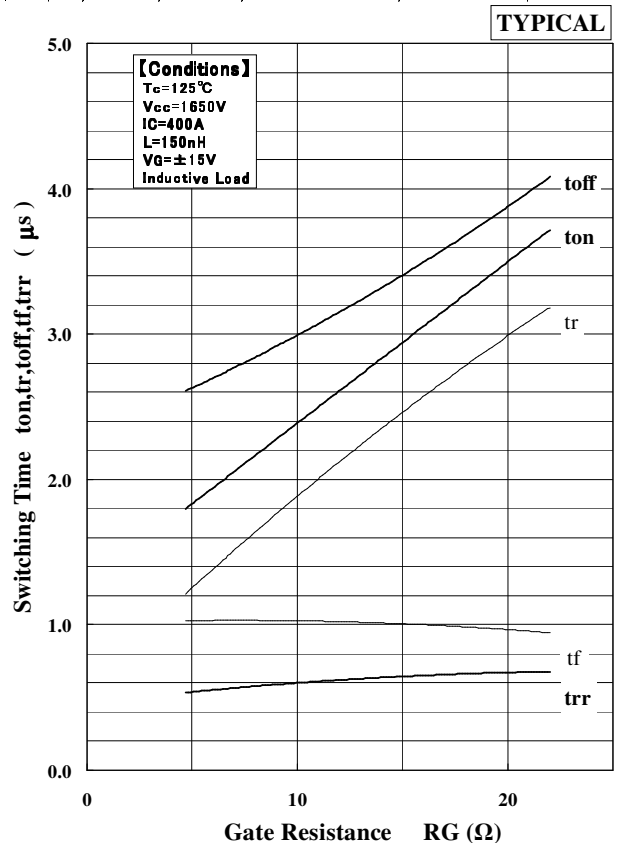
Turn-on Loss vs. Gate Resistance



Turn-off Loss vs. Gate Resistance



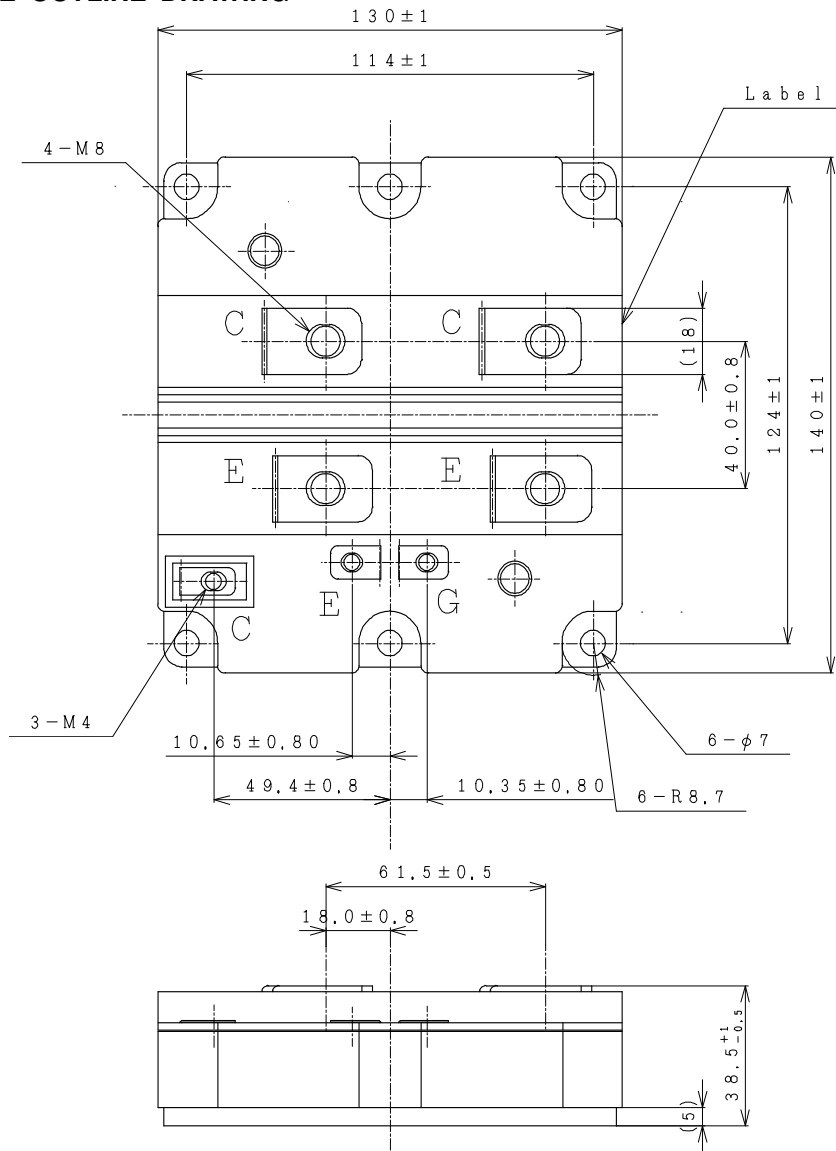
Recovery Loss vs. Gate Resistance



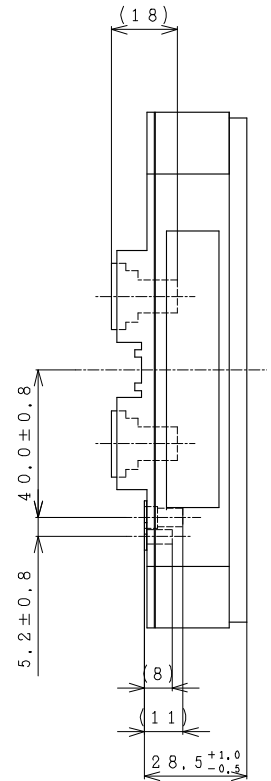
Switching Time vs. Gate Resistance

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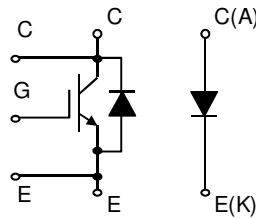
PACKAGE OUTLINE DRAWING



Unit in mm



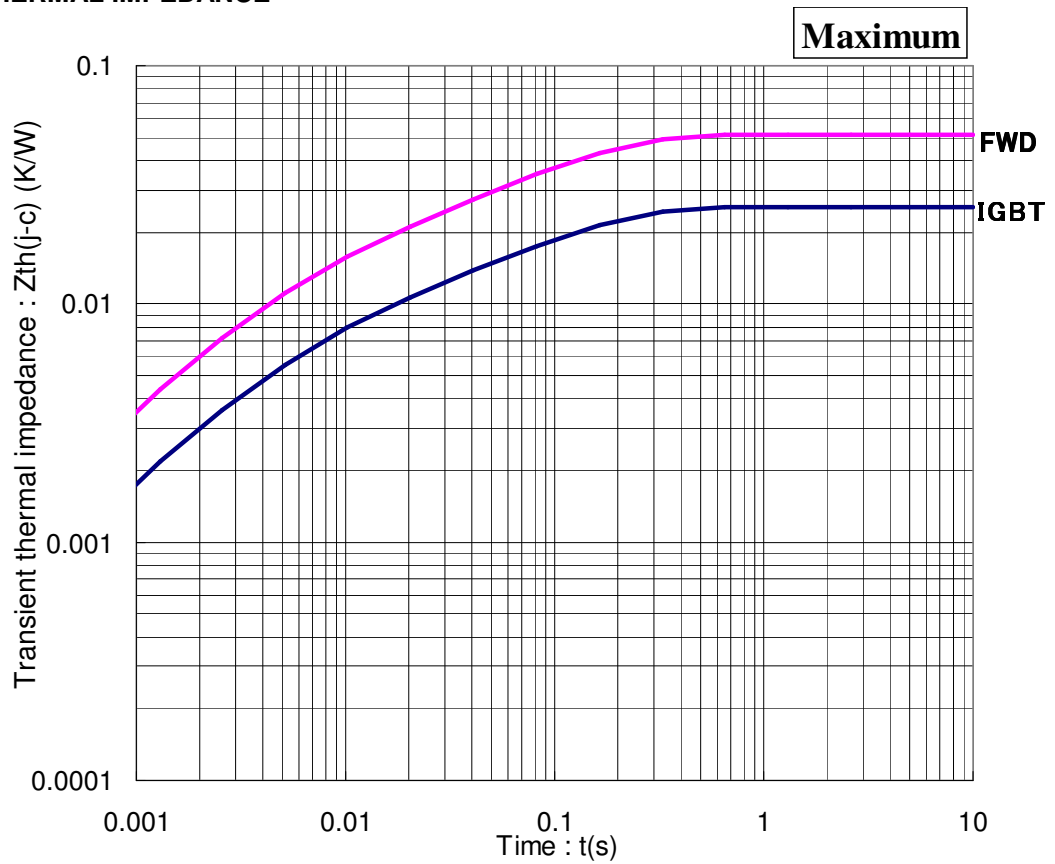
Weight: 900(g)



Circuit diagram

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TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve

Material declaration

Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

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HITACHI POWER SEMICONDUCTORS

Notices

1. The information given herein, including the specifications and dimensions, is subject to change without prior notice to improve product characteristics. Before ordering, purchasers are advised to contact Hitachi sales department for the latest version of this data sheets.
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